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ST-elevation in an adolescent with COVID-19: Myopericarditis or myocardial infarction?

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ABSTRACT

Myocardial infarctions (MI) have been reported in adults with COVID-19. Although MIs are rare in children with COVID-19, cardiac involvement is still possible. In this case report, we present an adolescent with recent COVID-19 infection who presented with an ECG initially suggestive of myocardial infarction (MI). We describe how to differentiate between myocardial infarctions and myopericarditis. A 15-year-old boy, with a history of COVID-19 infection a month prior, presented to the emergency department with fever, abdominal pain, diarrhea, and chest pain. On ECG, he was found to have focal ST-segment elevations in V3 through V6. Given the immediate concern for MI, an emergent echocardiogram was done and showed normal left ventricular systolic function with no regional dyskinesia and normal coronary artery diameters. A repeat ECG showed diffuse ST elevations in the inferior leads and T-wave inversions on V5 and V6, confirming the diagnosis of myopericarditis. In conclusion, multisystem-inflammatory syndrome in children associated with COVID-19 (MIS-C) is a new entity describing a post-infectious inflammatory response in children with prior COVID-19 exposure. Cardiac involvement can include myopericarditis. Initial ECGs may show ST-changes suggestive of MI. However, serial ECGs and echocardiograms can differentiate between MI and myocarditis/myopericarditis. Even with COVID-19, MIs are extremely rare in children, and it is important to be aware of MIS-C and its cardiac complications.

1. Background

Myocardial infarctions (MIs) have been reported in adults with COVID-19 but remain extremely rare in children. We present a case of a patient who presented with ECG findings initially suggestive of MI but was ultimately diagnosed with myopericarditis associated with Multisystem Inflammatory Syndrome in Children (MIS-C), a new post-infectious inflammatory complication of COVID-19 exposure. We describe how to differentiate between MI and myopericarditis in patients with MIS-C.

2. Case presentation

A 15-year-old male, who had COVID-19 infection a month prior, presented in the emergency department with 4 days of fever, abdominal pain, diarrhea, and chest pain. He had normal vital signs. Investigations revealed a CRP of 287.1 mg/L (normal 0.1–1.7 mg/L), an ESR of 64 mm/h (normal 2-28 mm/h), thrombocytopenia to 106×10^9/L, lymphopenia to 0.46×10^9/L and an elevated ferritin of 756.8μg/L (normal 11.1–171.9μg/L).

His troponin I was 1.74 ng/mL (normal<0.04 ng/mL) and his N-terminal pro-brain natriuretic peptide (NT-proBNP) was 1458 pg/mL (normal<125.0 pg/mL). Initial ECG (Fig. 1) revealed 3–5 mm ST segment elevations in V3 through V6. Because of concerns for MI, the patient was given aspirin, sublingual nitroglycerin, and placed on supplemental oxygen after cardiology consultation. An emergent echocardiogram showed good left ventricular systolic function, no regional dyskinesia and normal coronary artery diameter. Since the echocardiogram was normal, an acute coronary event was deemed unlikely, and the patient was admitted with the presumptive diagnosis of myopericarditis secondary to MIS-C. Repeat ECG (Fig. 2) the next day revealed a reduction of ST elevation in the anterolateral precordial leads, but now with >1 mm ST elevation in the inferior leads. In addition, the T waves in V5 and V6 had become inverted.

He was treated with IV methylprednisolone, IV immunoglobulin, and daily aspirin. Repeat echocardiogram on day 3 showed a small left anterior descending coronary aneurysm, normally sized right coronary artery, and good ventricular systolic function. The patient was discharged on day 3 of hospitalization with no residual cardiac or

Abbreviations: CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; MI, myocardial infarction; MIS-C, Multisystem inflammatory syndrome in children associated with COVID-19; NT-pro-BNP, N-terminal pro-brain natriuretic peptide; STEMI, ST-elevation myocardial infarction.

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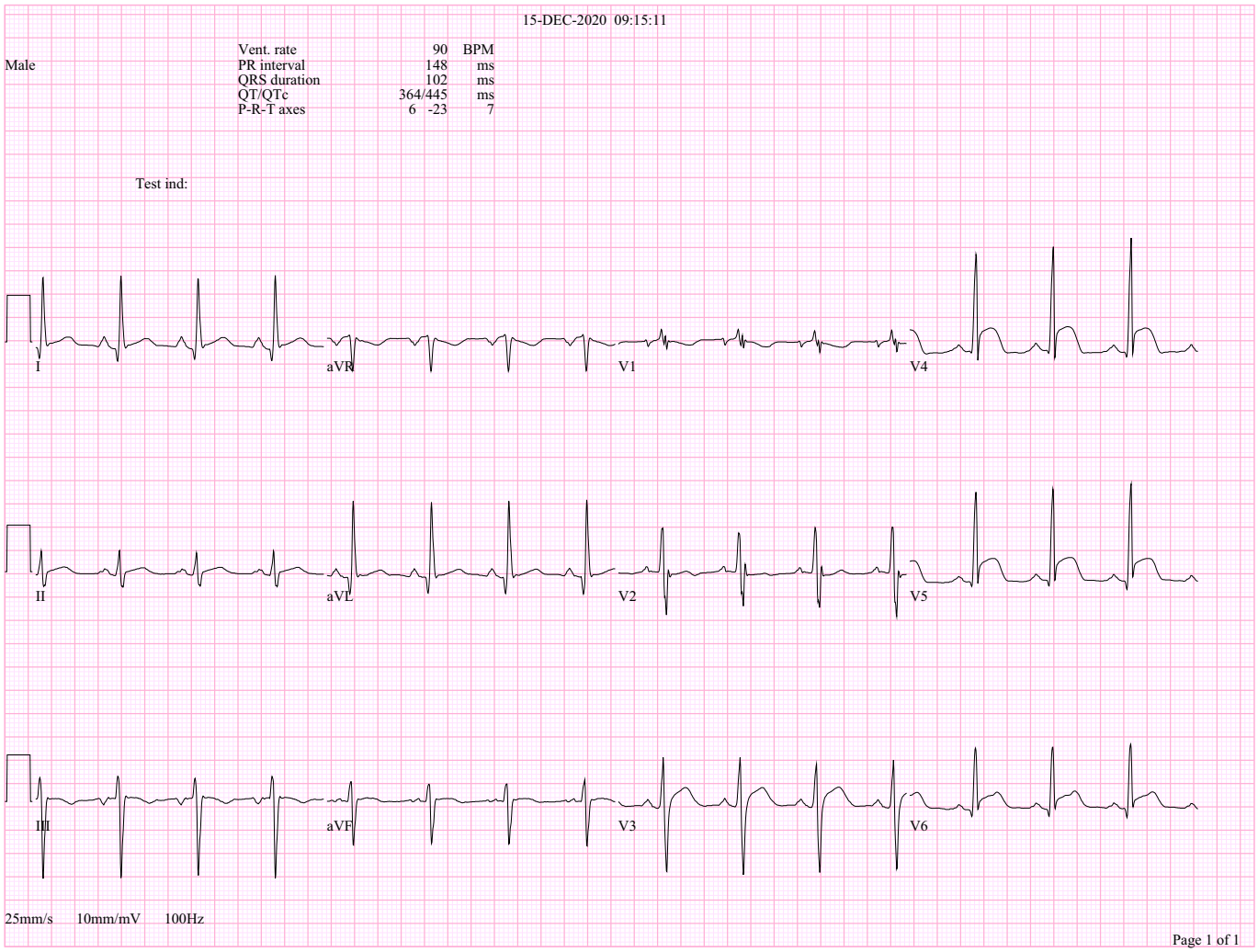

Fig. 1. Initial ECG showing ST segment elevations in V3 through V6.

gastrointestinal symptoms and a prescription for prednisolone taper and aspirin, with cardiology follow-up.

A week later, the patient's symptoms returned to baseline. Close follow-up with cardiology revealed improving coronary artery diameters that ultimately normalized. ECG showed normal sinus rhythm with non-specific ST-segment and T-wave changes. The patient was discharged from cardiology five months later with no cardiac sequelae.

3. Discussion

Although ST elevation myocardial infarction (STEMI) has been described in adults with COVID-19, only one case has been reported in children [1]. There is, however, a growing number of children who present with myopericarditis in the context of MIS-C. [2,3] The hallmark feature of MIS-C is high persistent fevers for ≥3 days with features of marked systemic inflammation and a temporal association with COVID-19 present in the community 3–6 weeks prior to presentation [4]. The pathophysiology of MIS-C is thought to be a post-infectious inflammatory process related with COVID-19 infection [4].

Pericarditis is inflammation of the pericardium. Although the pericardium is electrically silent, ECG anomalies can be found secondary to pericardial effusion or inflammation of the adjacent superficial myocardium [5]. ECG findings typically show diffuse concave ST elevations [6]. Myocarditis is inflammation of the myocardium in the absence of ischemia and may demonstrate nonspecific ST segment abnormalities, T-waves abnormalities, conduction abnormalities or decreased QRS voltage [6]. ECG changes in MIS-C are most consistent with changes seen in myopericarditis: low amplitude ECGs, transient T-wave inversion in lateral precordial leads, either non-specific or diffuse evolving ST changes, and rarely AV block.[1,7] Compared to MI, ST-segment changes in myopericarditis tend to be less pronounced, rarely exceeding 4-5 mm. In addition, those changes tend to be seen on multiple leads: I, II, V5 and V6 with reciprocal changes in aVR and V1. Furthermore, in myopericarditis, T-wave changes are usually present in all leads except aVR and V1, and are less deep or incompletely inverted. Finally, ECG changes in myopericarditis tend to happen more slowly and recover faster compared to MI [5].

Our patient had an initially concerning ECG for MI, but the evolution of diffuse ST elevations and T wave inversions on subsequent ECG indicated myopericarditis. On echocardiogram, STEMI generally will reveal focal wall motion abnormality, whereas myocarditis will likely demonstrate either normal wall motion or global systolic dysfunction [8]. Coronary artery aneurysms or dilatations may also be present, in addition to elevated levels of BNP and troponin [8]. Our patient's echocardiogram findings therefore supports the final diagnosis of myopericarditis rather than a true ischemic event.

Myocarditis from MIS-C can be associated with significant morbidity including multi-organ failure, heart failure and arrhythmias [2]. Treatment includes immunomodulatory drugs, including IV immunoglobulin and systemic glucocorticoids [9,10]. In most cases, the patient's ventricular function normalizes but the long-term effect remains unclear [11].

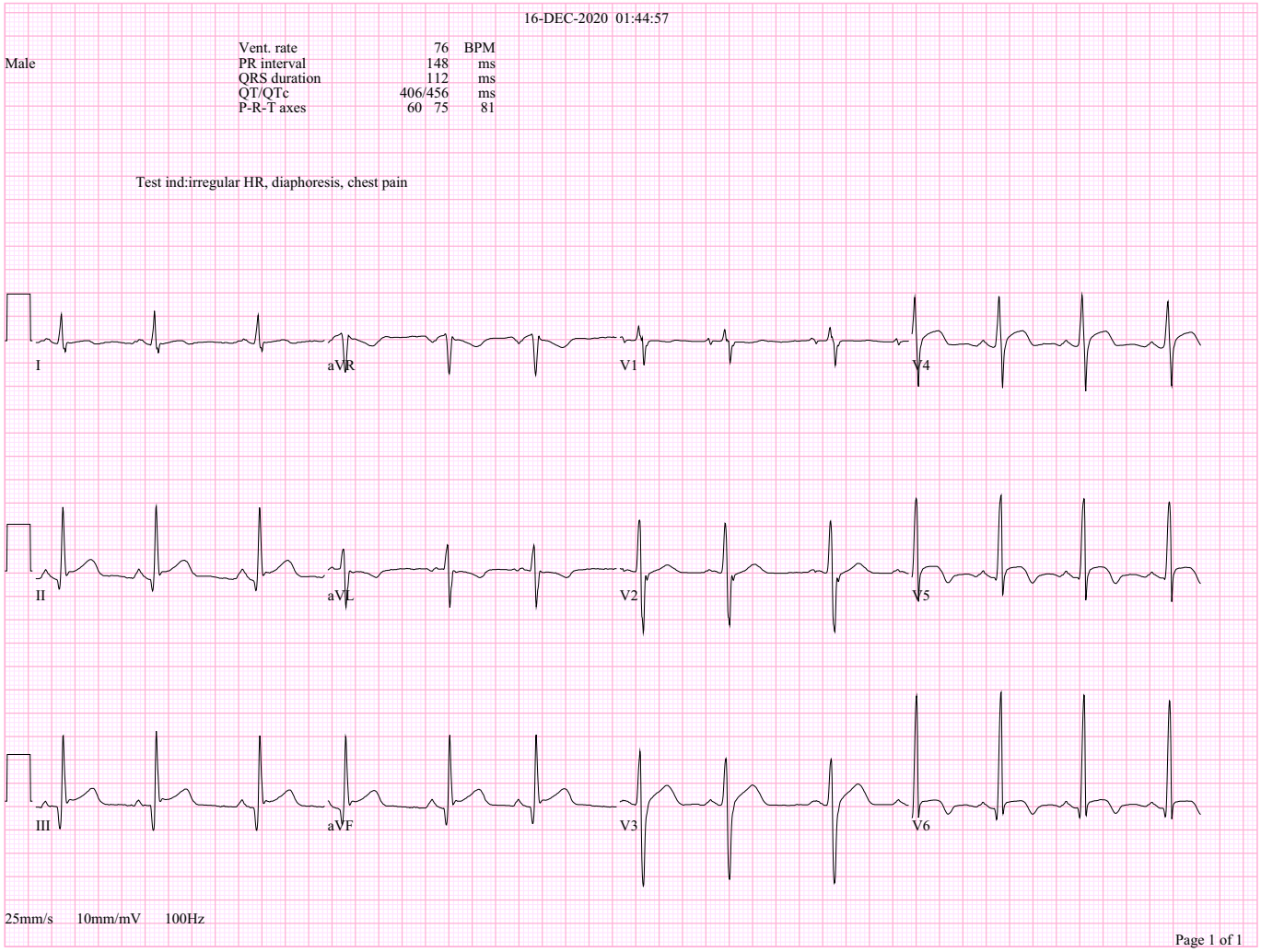

Fig. 2. Repeat ECG showing diffuse ST elevation in anterolateral precordial leads and inferior leads.

In conclusion, children presenting with myopericarditis in the context of MIS-C may show ST-changes suggestive of STEMI. Serial ECGs and echocardiograms can differentiate between MI and myocarditis/myopericarditis. It is important to recognize MIS-C and its cardiac complications among children to initiate the appropriate treatment and management.

Declaration of Competing Interest

none.

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